Honors Pre-Calculus **3.5 D1 Worksheet** **Name____________________________________**
Exponential Growth and Decay

Exponential Growth:

Exponential Decay:

Compound Interest:

Compound Interest Continuously:

$\boldsymbol{n =}$ **1**
$\boldsymbol{n =}$ **2**
$\boldsymbol{n =}$ **4**
$\boldsymbol{n =}$ **12**
$\boldsymbol{n =}$ **52**
$\boldsymbol{n =}$ **365**

1. The value in dollars of a car t years from now is $V(t) = 12{,}500(0.85)^t$.

a. What is the annual rate of depreciation, the rate at which the car loses value?

b. In how many years will the value of the car be approximately half what it is now?

2. The value of a car in dollars t years from now is $V(t) = 4000(0.79)^t$.

a. What is the annual rate of depreciation (the rate at which the car loses value?)

b. In how many years will the value of the car be approximately 30% what it is now?

3. The value of a new car decreases 20% each year. The value $V(t)$ of the car is in dollars and its age t is in years. In how many years will the value of the car be approximately one-fourth of what it is now?

4. The cost of a certain brand of camera has been increasing at 8% per year. If a camera now costs $\$150$, find the cost:

a. 2 years and 6 months from now **b.** 4 years and 3 months ago

5. The value of a computer depreciates at the rate of 25% per year. If a computer is now worth $\$2400$, find its approximate value:

a. 3 years and 6 months from now **b.** 20 months ago

6. Complete the table below. The cost of each item grows exponentially.

	Item	**Annual Rate of Increase**	**Cost Now**	**Cost in 10 years**	**Cost in 20 years**
a.	Airplane Ticket	15%	$300		
b.	Jar of Mustard	7%	$1		
c.	College Tuition	10%	$12000		

7. Complete the table below. The value of each item decays exponentially.

	Item	**Annual Rate of Decrease**	**Cost Now**	**Value in 3 years**	**Value in 6 years**
a.	Farm Tractor	25%	$65000		
b.	Value of the Dollar	6%	$1		
c.	Value of the Dollar	8%	$1		

8. If $1000 is invested so that it grows at the rate of 10% per year, what will the investment be worth in 20 years?

9. Suppose you invest $500 at 6% annual interest. Calculate the amount you would have after one year if the interest is compounded as follows:

a. quarterly

b. monthly

c. daily

d. continuously

EFFECTIVE ANNUAL YIELD:

10. Find the **effective annual yield** for each answer in #9.

a.

b.

c.

d.

e. Why are these four answers greater than the original interest rate in #9?

11. One hundred dollars deposited in a bank that compounds interest quarterly yields $107.50 over 1 year.

a. Find the annual interest rate

b. Find the effective annual yield

12. After a year during which interest is compounded quarterly, an investment of $800 is worth $851. What is the effective annual yield?

13. With which plan would an investor earn more, Plan A or Plan B

Plan A: A 6% annual rate compounded annually over a 10-year period
Plan B: A 5.5% annual rate compounded quarterly over a 10-year period

14. With which plan would an investor earn more, Plan A or Plan B

Plan A: A 8% annual rate compounded quarterly over a 5-year period
Plan B: A 7.5% annual rate compounded daily over a 5-year period

15. Suppose that $1000 is invested at 7% interest compounded continuously. How much money would be in the bank after 5 years?

16. Suppose $5000 is compounded continuously, and in 10 years, you have $5665.74.

a. What is the annual percentage rate?

b. How long does it take to for the $5000 to double at that rate?

17. Suppose $7500 takes 21 years to double when compounded continuously.

a. What is the annual percentage rate?

b. How much will be in the account after 10 years?

18. You invest $2400 in a certificate of deposit (CD) that compounds interest monthly at a rate of 2.25%. How long will it take the $2400 to grow to $3200, if no deposits or withdrawals are made?

19. A sum of $1000 is invested at an interest rate of 4.1% per year. Find the time required for the amount to grow to $4000 if interest is compounded continuously.

20. Find the time required for an investment of $5000 to grow to $8000 at an interest rate of 7.5% per year, compounded quarterly.

21. A sum of $1000 is invested for four years, and the interest is compounded semiannually. If this sum amounted to $1435.77 in the given time, what was the interest rate?

22. A sum of $2000 is invested at an interest rate of 3.25% per year. Find the time for the money to double if the interest is compounded according to the following method.

a. semiannually **b**. monthly **c**. continuously

RULE OF 72

23. Use the Rule of 72 to estimate how long a $2000 investment, invested at a rate of 3.25%, would take to double? Why is this amount *more* than the answers in #22?

24. Suppose that $1000 is invested at 8% interest compounded annually. How long would it take for the investment to double?

25. Suppose that $2050 is invested at 6% interest compounded monthly. How long would it take for the investment to double?

26. Suppose that $3200 is invested at 2.5% interest compounded monthly. How long would it take for the investment to double?

Answers

1a. 15%
1b. 4.27 years
2a. 21%
2b. 5.11 years
3. 6.21 years

4a. $181.82
4b. $108.15
5a. $876.85
5b. $3876.52

6a. $1213.67, $4909.96
6b. $1.97, $3.87
6c. $31124.91, $80730.00

7a. $27421.88, $11568.60
7b. $0.83, $0.69
7c. $0.78, $0.61

8. $6727.50
9a. $530.68
9b. $530.84
9c. $530.92
9d. $530.92

10a. 6.136%
10b. 6.168%
10c. 6.184%
10d. 6.184%

10e. These are the actual rates that were applied, based on the frequency by which the $500 was compounded

11a. 7.3%
11b. 7.5%
12. 6.375%
13. Plan A
14. Plan A

15. $1419.07
16a. 1.25%
16b. 55.45 years
17a. 3.3%
17b. $10432.26

18. 12.8 years
19. 33.8 years
20. 6.33 years
21. 9.25%
22a. 21.5 years

22b. 21.4 years
22c. 21.3 years

23. 22.2 years; Because of the frequency with which the $2000 investment is compounded. The Rule of 72 is an *estimate* – the more often the money is actually compounded, the faster it will reach the doubled amount.

24. 9 years
25. 12 years
26. 28.8 years